

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings of claims in the application:

Listing of Claims:

1. - 40. (Canceled).

41. (New) An apparatus for performing frame classification and rate determination in a transcoding process operating on a source bitstream coded in a source voice codec, the transcoding process being performed without reconstructing a voice signal, the apparatus comprising:

a source bitstream unpacker associated with the source codec, the source bitstream unpacker being operative to generate one or more parameters;

a buffer coupled to the source bitstream unpacker and operative to store one or more frame classification and rate determination parameters; and

a frame classification and rate determination module coupled to the source bitstream unpacker and the buffer, the frame classification and rate determination module being operative to output a frame class and a rate for the destination voice codec through the use of one or more parameters associated with the source bitstream coded in the source voice codec and free from the use of a voice signal.

42. (New) The apparatus of claim 41 wherein the source bitstream unpacker comprises:

a code separator operative to receive the source bitstream coded by the source voice codec and separate one or more indices representing one or more compression parameters associated with the source voice codec;

one or more unquantizer modules coupled to the code separator, the one or more unquantizer modules operative to unquantize the one or more indices to provide one or more compression parameters associated the source voice codec; and

a classifier input parameter selector coupled to the one or more unquantizer modules, the classifier input parameter selector operative to determine which compression parameters will be used in a classification process.

43. (New) The apparatus of claim 41 wherein the buffer comprises:

an input parameter buffer operative to store one or more of the input parameters associated with one or more previous frames for the frame classification and rate determination module;

an output parameter buffer coupled to the input parameter buffer and operative to store the output parameters associated with one or more previous frames for the frame classification and rate determination module;

an intermediate data buffer coupled to the output parameter buffer and operative to store one or more states associated with one or more current frames; and

a command buffer coupled to the intermediate data buffer and operative to store one or more external control signals associated with the one or more previous frames.

44. (New) The apparatus of claim 41 wherein the source voice codec comprises bit stream information, the bit stream information including pitch gains, fixed codebook gains, and/or spectral shape parameters.

45. (New) The apparatus of claim 41 wherein the frame classification and rate determination module operative to output a frame class and a rate for the destination voice codec does not include a stage of speech signal pre-processing in the destination voice codec.

46. (New) The apparatus of claim 41 wherein the source bitstream unpacker operates to generate one or more parameters without decoding a voice signal.

47. (New) The apparatus of claim 41 wherein the one or more frame classification and rate determination parameters further comprise of:

one or more input parameters of the frame classification and rate determination module associated with the one or more previous frames;

one or more intermediate parameters of the frame classification and rate determination module;

one or more classified outputs of the frame classification and determination module associated with the one or more previous frames; and

one or more external commands associated with the one or more previous frames.

48. (New) The apparatus of claim 41 wherein the source voice codec is EVRC and the destination voice codec is SMV.

49. (New) The apparatus of claim 41 wherein the source voice codec is SMV and the destination voice codec is EVRC.

50. (New) The apparatus of claim 41 wherein the frame classification and rate determination module performs frame classification and rate determination without reconstructing a voice signal and wherein the frame classification and rate determination module further comprises:

a classifier comprising one or more feature sub-classifiers, the one or more feature sub-classifiers operative to perform a particular feature classification or a pattern classification without reconstructing a voice signal, wherein the one or more feature sub-classifiers have one or more coefficients provided by a training process; and

a decision module coupled to the one or more feature sub-classifiers, the decision module being associated with a source voice codec and a destination voice codec, the decision module operative to produce one or more results associated with a frame class and a rate decision of a destination voice codec based on one or more sets of input data.

51. (New) The apparatus of claim 50 wherein the one or more feature sub-classifiers comprise a plurality of pre-installed coefficients maintained in memory.

52. (New) The apparatus of claim 51 wherein the pre-installed coefficients in the one or more feature sub-classifiers are derived from a classification construction module.

53. (New) The apparatus of claim 52 wherein the classifier construction module comprises:

a training set generation module;
a classifier training module; and

a classifier evaluation module.

54. (New) The apparatus of claim 51 wherein the pre-installed coefficients in the one of more feature sub-classifiers are data types from logical relationships, a decision tree, decision rules, weights of artificial neural networks, or numerical coefficient data in analytical formula.

55. (New) The apparatus of claim 50 wherein the one or more feature sub-classifiers are associated with the destination voice codec and one or more external command signals.

56. (New) The apparatus of claim 50 wherein each of the one or more feature sub-classifiers receives an input of selected classification input parameters, past selected classification input parameters, past output parameters, and selected outputs of the other sub-classifiers.

57. (New) The apparatus of claim 50 wherein each of the one or more feature sub-classifiers determines the class or value of a feature which contributes to one or more of the decision outputs of the frame classification and rate determination module and comprises a structure of a different classification process.

58. (New) The apparatus of claim 50 wherein one of the one or more feature sub-classifiers determines the class or value of a feature which contributes to one or more of the decision outputs of the frame classification and rate determination module and comprises an artificial neural network multi-layer perceptron classifier.

59. (New) The apparatus of claim 50 wherein one of the feature sub-classifiers determines the class or value of a feature which contributes to one or more of the decision outputs of the frame classification and rate determination module and comprises a decision tree classifier.

60. (New) The apparatus of claim 50 wherein one of the feature sub-classifiers determines the class or value of a feature which contributes to one or more of the

decision outputs of the frame classification and rate determination module and comprises a rule-based model classifier.

61. (New) The apparatus of claim 50 wherein the decision module enforces the rate, class and classification feature parameter limitations of the destination codec, so as not to allow illegal rate transitions from frame to frame or so as not to allow a conflicting combination of rate, class, and classification feature parameters within the current frame.

62. (New) The apparatus of claim 50 wherein the decision module favors preferred rate and class combinations based on the source and destination codec combination in order to improve the quality of the synthesized speech, or to reduce computational complexity, or to otherwise gain in performance.

63. (New) The apparatus of claim 50 wherein the one or more sets of input data consist of:

- one or more outputs from each of the one or more feature sub-classifiers;
- one or more combinations and transitions of allowable rate and frame classes associated with the destination voice codec;
- one or more intermediate data associated with one or more previous frames;
- one or more parameters associated with a source voice codec; and
- one or more external control signals.

64. (New) The apparatus of claim 50 wherein the one or more feature sub-classifiers determine one or more pre-encoded speech characteristics from a set of encoded speech parameters.

65. (New) The apparatus of claim 50 wherein the one or more coefficients in the one or more feature sub-classifiers can be mixed data types of logical relationships, decision tree, decision rules, weights of artificial neural networks, or numerical coefficient data in analytical formula when more than one classification or prediction structure is used for the one or more feature sub-classifiers.

66. (New) A method for producing a frame class and a rate for a destination codec in a transcoding process from a source codec to the destination codec without reconstructing a voice signal, the method comprising:

extracting one or more parameters from a source bitstream coded in the source codec;

retrieving one or more intermediate data parameters associated with one or more previous frames from a buffer;

processing the one or more parameters and the one or more intermediate data parameters utilizing a classification process, wherein the classification process has pre-determined coefficients and paths, the pre-determined coefficients and paths being associated with a training process; and

outputting a frame class and a rate decision for the destination codec.

67. (New) The method of claim 66 wherein the destination voice codec and the source voice codec are the same.

68. (New) The method of claim 66 wherein processing further comprises processing past classification input parameters.

69. (New) The method of claim 66 wherein processing further comprises processing past classification output parameters.

70. (New) The method of claim 66 wherein processing further comprises processing past intermediate parameters within the classification process.

71. (New) The method of claim 66 wherein processing comprises a direct pass-through of one or more input parameters.

72. (New) The method of claim 66 wherein extracting one or more parameters from the source bitstream coded in the source codec comprises:

determining a source code into component codes associated with one or more parameters;

processing the component codes using an unquantizing process to determine the one or more parameters; and

selecting one or more inputs parameters from the one or more parameters as inputs in the classification process.

73. (New) The method of claim 72 wherein the component codes are unquantized in accordance with the one or more parameters from the source codec to produce one or more intermediate speech parameters selected from one or more features including a plurality of pitch gains, a plurality of pitch lags, a plurality of fixed codebook gains, a plurality of line spectral frequencies, and a bit rate.

74. (New) The method of claim 66 wherein the classification process comprises:

receiving one or more parameters from a source bitstream unpacker;
classifying N parameters using M sub-classifiers of the classification process;
processing outputs of the M sub-classifiers to produce a frame class, a rate and classification feature parameters; and
providing the frame class, the rate, and classification feature parameters to a destination codec.

75. (New) The method of claim 74 wherein each of the M sub-classifier is derived from a pattern classification process.

76. (New) The method of claim 74 wherein each of the M sub-classifiers is derived using a large training set of input speech parameters and desired output classes and rates.